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Exploring Ozonated Mist as a Disinfection Method via Simulation-Based Evaluation

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Abstract

In recent years, ozone has gained popularity as a powerful disinfectant and sanitizer. As it can transform into harmless oxygen and disinfect challenging areas, it's a great disinfectant option for healthcare settings, such as an ambulance. However, ensuring the ambulance is fully sanitized is crucial because the ozone water mist needs to be distributed without human intervention; hence, an ozone generator with self-activation is applied to disinfect the air and surfaces. Furthermore, assessing ozone's efficacy and distribution in a sanitization system remains in a preliminary phase, highlighting the importance of studying the behavior, visualization, and efficiency of ozone mist. This study provides a transient Computational Fluid Dynamics (CFD) simulation of ozone mist dispersion in a small, enclosed space possessing minimal air outlets. Unlike steady-state models that only capture peak exposure conditions, the time-dependent approach used here allows for observation of both the build-up and subsequent decline of ozone concentration over time. The simulation results show that ozone levels rise rapidly during the first 60 seconds due to mist generation and then begin to decrease as the ozone decays and escapes through the small opening. This behavior closely resembles actual disinfection scenarios, in which regulated ozone emissions must be followed by adequate decay or ventilation before re-entry. By integrating boundary leakage and transient modeling, the research provides a significant understanding of how operational timing influences ozone retention and dispersion. These findings play a significant role in the progression of safer ozone-based disinfection techniques, especially in mobile treatment environments such as ambulances.

Author keywords

Computational fluid dynamic; Concentration; Dispersion; Emergency transport vehicle; Ozone; Ozone mist

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